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Proceedings of the Society.

CANTOR LECTURES.

"ON CHEMISTRY APPLIED TO THE ARTS." BY DR. F. CRACE CALVERT, F.R.S., F.C.S.

LECTURE VI.*

DELIVERED ON THURSDAY EVENING, APRIL 28, 1864.

Flesh, its chief constituents, boiling and roasting. *Animal black*, its manufacture and applications. Various methods of preserving animal matters. Employment of animal refuse in the manufacture of *prussiate of potash*. A few words on the decay of organic matters, and their fermentation and putrefaction.

It will be easily understood, by those who have done me the honour of attending this course, that this last lecture must touch upon a variety of topics, in order to give an idea of some of the applications which animal matters receive, and which yet remain to be discussed.

Flesh.—M. Chevreul, in 1835, and Baron Liebig, in 1845, examined the changes which flesh undergoes when place in contact with hot and cold water; and the following table, taken from Liebig's interesting work on the chemistry of food, will give you an idea of the composition of flesh:—

Cold water.		Action of boiling.	
Soluble	66	Coagulated albumen	29·5
		Gelatine	6·0
		In solution	30·5
Insoluble	164	Fibres and membranes	164·0
Fat	20		
Water	750		
	1000		

Liebig and Chevreul further succeeded in isolating, from the 30 parts soluble in water, some of the following substances:—

Kreatine	$C_8 H_9 N_3 O_4 + 2HO$
Kreatinine	$C_8 H_7 N_7 O_2$
Sarcosine	$C_6 H_7 N_3 O_4$
Inosinic acid	$C_{10} H_6 N_2 O_{10}$
Lactic acid	$C_6 H_5 O_5 + HO$
Guanine (Scherer)	$C_{10} H_5 N_5 O_2$
Xanthine (Strecker)	$C_{10} H_4 N_4 O_4$
Glycocalle ,,	$C_4 H_5 N_1 O_4$
Leucine (Cloetta)	$C_{12} H_{13} N_1 O_4$
Osmazone	

The most important mineral salts in flesh are the acid phosphate and lactate of lime, and, according to Fremy, the acid phosphate of potash and chloride of potassium. The above statement shows that flesh is a most complicated substance, and it is easy to conceive that this must be so, when it is remembered that it is derived from blood, of which it contains a large amount; but a most interesting and curious fact is that, whilst blood is rich in salts of soda and poor in salts of potash, in flesh the relative proportion of these salts is directly reversed. Another interesting fact is the small amount of solid matter contained in flesh, and also the small amount of nutritive matter it yields to water under the most favourable circumstances. I repeat "the most favourable circumstances," for when meat is placed in boiling water the 3 per cent. of albumen it contains is coagulated, closing the vessels of the flesh, and preventing all further exit of the fleshy fluids, and such should be the case when meat is intended to be eaten as boiled meat and is properly cooked; but when the object in view is to extract the whole of the matter soluble in water, as in the preparation of beef tea, then the meat should be cut in small pieces, and brayed in a mortar with water, the whole then thrown into clean linen and pressed. The juice of the flesh so obtained should then be carried just to the boil, again passed through the strainer, and after the addition of a little common salt will be ready for the patient. Beef tea, even prepared by this process, which is certainly the best to my knowledge, contains, as the table above shows, but a small quantity of nutritive matter, there being only a little gelatine and a small proportion of the other substances named above. Chevreul attributes the odour of beef tea and meat soups to osmazone, and Liebig to kreatine; in fact, Liebig considers kreatine to be one of the essential substances characterising the aroma of various kinds of flesh. Liebig during his researches on this substance succeeded in obtaining from—

Fowls' flesh	3·21	of kreatine.
Ox heart	1·37	,,
Pigeon	0·82	,,
Beef	0·69	,,

Further he observed, that the flesh of wild animals contained a much larger proportion of kreatine than that of those which were confined; for instance, that there was six times as much in the flesh of a wild fox as in that of a tame one. Allow me to say a few words on the properties of this curious substance, which presents itself in the form of moderately large white rectangular prisms, having a pearly lustre, soluble in water, insoluble in alcohol. Although this substance is neutral, it is converted when heated with hydrochloric acid into another solid crystallized substance called kreatinine, which possesses strong alkaline properties. When kreatine, instead of being treated by an acid is acted upon by baryta, it is converted into an acid compound called inosinic acid. Liebig ultimately succeeded in finding these substances, as well as another called sarcosine, in various animal secretions. I shall not take up more of your time by discussing the chemical properties of these substances, but merely state that they enable us to distinguish real soup tablets from spurious

* This lecture was No. V. when the course was delivered.

ones. For this purpose a solution of the tablet in cold water should be made, when, if genuine, it will give a precipitate with chloride of zinc, whilst the spurious one, which contains gelatine but no kreatine, will not do so. Another reaction is, that the pure article will yield 85 per cent. of its weight to alcohol, whilst the imitation will only yield about five.

Preservation of meat and animal substances.—A low temperature is most favourable to the preservation of flesh and other animal substances, and under that condition it will not enter into putrefaction, the best proof of which is that elephants in a perfect state of preservation have been found in Siberia buried in ice, where they have doubtless existed for many thousands of years. It is also well known that the inhabitants of polar regions preserve their meat fresh by burying it in snow, and I mentioned an instance in one of my previous lectures, viz., the preservation and bleaching of sturgeon's bladders on the banks of the Volga. A high state of desiccation or dryness also contributes powerfully to the prevention of decay. Thus in Buenos Ayres and Monte Video meat is cut into thin slices, covered with maize flour, dried in the sun, and it is consumed largely, under the name of tasago or charke, by the inhabitants of the interior, and also by the black population in Brazil and the West Indies. Further, dried meat reduced to powder is used by travellers in Tartary and adjacent countries, and I may add that of late years meat biscuits have been extensively consumed by the emigrants having to travel from the United States to California and the West Coast generally. It is stated that six ounces per diem of this meat biscuit will maintain a man in good health throughout the journey. A remarkable instance of the preservation of animal matter by extreme desiccation is related by Dr. Wefer, who states that in 1787, during a journey in Peru, he found on the borders of the sea many hundreds of corpses slightly buried in the sand, which, though they had evidently remained there for two or three centuries, were perfectly dry and free from putrefaction. Although it is not within the scope of these lectures to describe the preservation of vegetable matters, still I cannot refrain from mentioning the interesting method adopted by MM. Masson and Gannal, by which, as you are doubtless aware, vegetables are preserved in the most perfect manner. Their process is most simple, as it consists in submitting the vegetables for a few minutes to the action of high pressure steam (70 lbs. to the square inch), then drying them by air heated to 100°, when, after compression by hydraulic pressure, they are made into tablets for sale, and when required for use it is only necessary to place the tablets for five hours in cold water, when the vegetable substances swell out to their former size and appearance and are ready for cooking. As the presence of oxygen or air is an essential condition of putrefaction, the consequence is that many methods have been invented to exclude that agent, or rather, as I shall show at the end of this lecture, the sporules or germs of cryptogamic plants or animals, which are the true ferments or microscopic source of fermentation and putrefaction. Permit me to describe concisely some of the methods proposed; and I believe that one of the best processes for excluding air was that invented by Appert, in 1804. It consists in introducing the meat or other animal substance with some water into vessels which are nearly closed, these are then placed in a large boiler with salt (which raises the boiling point of the liquor), and the contents of the vessels are kept boiling for about an hour, so as to exclude all air, and destroy, by the high temperature, all the sporules or germs of putrefaction they may contain, when they are hermetically closed. M. Chevalier Appert has improved this process in placing the prepared vessels in a closed boiler, by which means he raises the temperature (by pressure) to 234°, effecting thus the same purpose more rapidly and economically. To give you an idea of the extent of this trade, I may state that M. Chevalier Appert prepared above 500,000 lbs. of meat for the French Army in the Crimea. I am aware that many modifications have been applied to this process, but I shall only mention that of Mr. G. McAll, who adds to the previous principle of preservation a small quantity of sulphate of soda, well known to be a powerful antiseptic. The beautiful specimens now on the table, which have been kindly lent to me by Messrs. Fortnum and Mason and by Mr. McAll, will satisfy you of the applicability of the above-named methods for the preservation of meat and other animal substances. But before concluding this part of my lecture, I must add that the preservation of animal and vegetable substances by the exclusion of air and cryptogamic sporules is also effected by other methods than those above described; for instance, they are imbedded in oil, or in glycerine, as suggested by Mr. G. Wilson, or in saccharine syrups. I should not forget to mention that several plans have been proposed for protecting animal matter by covering their external surfaces with coatings impermeable to air. Two of the most recent are the following:—M. Pelletier has proposed to cover the animal matter with a layer of gum, then immerse it in acetate of alumina, and lastly in a solution of gelatine, allowing the whole to dry on the surface of the animal matter. The characteristic of this method is the use of acetate of alumina which is not only a powerful antiseptic, but also forms an insoluble compound with gelatine, thus protecting the animal matter from external injury. Mr. Pagliari has lately introduced a method which is stated to give very good results. It consist in boiling benzoin resin in a solution of alum, immersing the animal matter in the solution, and driving off the excess of moisture by a current of hot air, which leaves the above antiseptics on the animal matter. It is scarcely necessary to mention the old method of using smoke arising from the combustion of various kinds of wood, except to state that in this case it is the creosote and pyroligneous acids which are the preservative agents. The preservation of animal matter by a very similar action is effected by the use of carbolic acid, a product obtained from coal tar. It is much to be regretted that this substance, which is the most powerful antiseptic known, cannot be made available for the preservation of food, but there can be no doubt that for the preservation of organic substances intended for use in arts and manufactures, no cheaper or more effective material can be found. For example, I have ascertained that one part of carbolic acid added to five thousand parts of a strong solution of glue will keep it perfectly sweet for at least two years, and probably for an indefinite period. Also, if hides or skins are immersed for twenty-four hours in a solution of one part of carbolic acid to fifty of water, and then dried in the air, they will remain quite sweet. In fact, hides and bones so prepared have been safely imported from Monte Video. From these facts and many others with which I am acquainted I firmly believe that this substance is destined within a few years, to be largely used as an antiseptic and disinfectant. I need hardly speak of the power of chloride of sodium, or common salt, in preserving animal matters, and it is highly probable that the interesting process described to you on the 13th April, by Mr. J. Morgan, for the employment of salt, is likely to render great service in preserving animal food from petrefaction. But with regard to the feasibility of its use in Monte Video and Buenos Ayres, I cannot offer an opinion, as it depends upon so many local circumstances which it is impossible to appreciate here. Messrs. Jones and Trevethick displayed at the last exhibition some meat, fowls, and game preserved by the following process, which received the approbation of the jurors. Meat is placed in a tin canister, which is then hermetically closed, with the exception of two small apertures in the lid. It is then plunged into a vessel containing water, and after the air has been exhausted through one aperture by means of an air pump, sulphurous aid gas is admitted through the second aperture, and the alternate action of exhausting the air

and replenishing the sulphurous acid gas is kept up until the whole of the air has been removed. The sulphurous acid gas in its turn is exhausted, and nitrogen admitted. The two apertures are then soldered up, and the operation is completed. As I consider the action of carbon on animal matters rather as a case of oxydation than of preservation, I shall refer to that subject further on, and shall, therefore, proceed to consider the employment of certain animal matters not yet alluded to during this course of lectures, such as the flesh of dead animals not used as food, and those other parts of their carcases which have not been applied in any of the processes already described. The greatest part of these refuse matters are used for producing animal black, which differs from bone black, referred to in my first lecture, being used in the state of impalpable powder, whilst bone black or char is composed of small hard grains. The manufacture of animal black is generally carried out by introducing into horizontal retorts connected with a coil or condenser, and with an exit pipe for the gases, some of the animal matters mentioned; on the application of heat decomposition occurs, the oily matters distil and condense in the worm, and constitute what is called oil of dippel, formerly much used in the art of currying certain classes of leather; water also distils, charged with a variety of ammoniacal salts, which are generally converted into sulphate of ammonia for agricultural purposes. As to the gases, they are usually ignited and burnt to waste. The carbonaceous mass which remains in the retort is removed, and ground to powder with water in a mill, allowed to settle, and, lastly, dried and sold under the name of animal black. Its chief uses are in the manufacture of blacking and printing ink. Another manufacture which consumes a large quantity of animal refuse, especially the horns, hoofs, &c., of too inferior a quality to be used for the purposes described in my first lecture, is that of the yellow prussiate of potash, a most important salt, for it is extensively used in calico printing, silk and wool dyeing, and in the manufacture of the pigment called prussian blue, for gilding silver, copper, and other inferior metals; and lastly, it is the source from which cyanide of potassium is procured, a substance much employed in the art of photography. Let me now call your attention to the manufacture of prussiate of potash, the greatest portion of which is still prepared at the present day by the old process devised by Dr. Woodward, F.R.S., in 1724. It consists in introducing into large cast-iron pots American pearlash, melting it, closing the vessel, and then setting the mass in motion by means of a revolving shaft. At this period of the operation, hoofs, horns, and other animal refuse, are introduced in small quantities at a time. Under the influence of heat and of the alkali, the nitrogen of the organic matters splits into two parts, one part combining with the hydrogen to form ammonia, which escapes, whilst the other portion unites with the carbon, producing cyanogen, which remains combined with the potassium of the potash. After several hours the operation is considered to be completed, and the melted mass is run out into small cast-iron receptacles; when cool, these are placed in large vats with water, and a jet of steam is introduced, and the whole is kept on the boil for several hours, when the cyanide of potassium is partly decomposed, giving rise to carbonate of potash and to cyanide of iron, for not only has a portion of the iron of the melting pots been attacked and combined with the mass, but a certain quantity of iron filings has been used during the operation. However, two parts of the cyanide of potassium combine with one part of cyanide of iron, and the result is that a double cyanide, called ferro-cyanide of potassium, or yellow prussiate of potash, is formed. The liquors are then allowed to clear by standing, and the aqueous solution is evaporated until a pellicle appears on its surface, when it is allowed to cool, and the salt is deposited on strings which have been passed through the crystallising vat, and which facilitate the crystallisation of the prussiate salt. In consequence of the large amount of animal matter used as compared with the quantity of prussiate obtained, this salt has always commanded a good price in the market, and has induced many eminent chemists to try to devise cheaper processes for obtaining it. To attempt here to give merely an outline of these various proposed plans would involve so much technical description as would occupy far too much time for this lecture, but I would recommend those interested in this branch of manufacture, to read the learned account given by Dr. A. W. Hoffmann, in his report on "The Chemical Products in the last Exhibition," page 57, where they will find the process of M. Gauthier-Bouchard for obtaining salts of cyanogen from the ammoniacal waters of gas works; those of Mr. R. T. Hughes and Messrs. Bramwell, of Newcastle, for the conversion of nitrogen of the atmosphere into cyanide of potassium; that of M. Kamrodt, for decomposing ammonia by carbon carried to a high temperature; and, lastly, that of MM. Marguerite, and De Sourdeval, for producing cyanogen from the nitrogen of the atmosphere and fixing it by means of barium. This latter process seems to be highly commended by the learned reporter to whom I have referred. I must not, however, omit to mention the scientific and interesting process devised by Mr. Gelis, and based on the chemical reaction which ensues when bisulphide of carbon is mixed with sulphide of ammonium. Yellow prussiate crystallises in large crystals belonging to the octohedral system, composed, as before stated, of two parts of cyanide of potassium, 2 Cy K, and one of iron, Cy Fe + 3 of water or H O. This salt is freely soluble in water, but is insoluble in alcohol, and when mixed with weak vitriol and heated gives rise to prussic acid, which distils, and may be used either as a violent poison or, in qualified hands, as a most valuable therapeutic agent. When ferrocyanide of potassium is heated with several times its bulk of concentrated sulphuric acid, instead of yielding prussic acid, as above, it gives rise to a poisonous gas, called oxide of carbon, which burns with a beautiful blue flame, and which we have all seen burning in our fireplaces when the combustible matter has lost all its volatile constituents and nothing remains but a red incandescent mass. When chlorine is passed through a solution of this salt chloride of potassium is formed, and the yellow prussiate is converted into red prussiate or ferricyanide of potassium, composed of 3 Cy K + 3 Fe_2 Cy_3. When heated with peroxide of mercury, potash, peroxide of iron, and cyanide of mercury are produced, the latter being a most violent poison. To produce Prussian blue on silk with this salt, all that is required is to dip the silk in a slightly acidulated liquor containing a persalt of iron, and when the silk is washed and mordaunted, it is dipped in a weak acidulated solution of yellow prussiate of potash, when it assumes a beautiful blue colour due to the formation of Prussian blue. To dye wool it is necessary to pass it through a boiling bath composed of yellow prussiate, muriate of tin, and a small quantity of sulphuric acid. Prussian blue is gradually formed, and fixes itself on the fibre. To produce blue on calicoes, a solution of yellow prussiate of potash is made, to which is added some tartaric acid and muriate of tin. This mixture, after having been properly thickened, is printed on the calico, and then submitted to the action of steam, the Prussian blue so produced being fixed on the cotton fibre by means of the oxide of tin, resulting from the decomposition of the salt employed.

Nothing is more simple than to gild or silver metals by means of ferrocyanide of potassium, or to cover iron and other metals with copper. To obtain a gilding liquor, it is only necessary to take 1,000 parts of water, adding to it 100 parts of yellow prussiate of potash, 10 parts of chloride of gold, and 1 part of caustic potash. Each of these should be added successively, and the whole of the liquor carried to the boil and filtered. It is then ready for gilding silver or brass objects, when properly attached to the pole of a galvanic battery. The silvering liquor is

made by substituting for the chloride of gold, in the above process, ferrocyanide of silver, prepared by adding nitrate of silver to a solution of ferrocyanide of potassium, the white precipitate resulting being washed and added to the liquor intended for silvering. For covering zinc or iron with copper it is simply necessary to substitute the ferrocyanide of copper for that of silver. Ferrocyanide of potassium, as above stated, is also employed for the manufacture of Prussian blue, which was accidentally discovered by Diesback, in 1718, by adding alum, containing iron, to the ammoniacal liquors sold to him by Dippel, which were produced, as already stated above, during the distillation of animal refuse. These liquors, being rich in cyanide compounds, yielded with the salt of iron of the alum, Prussian blue. At the present day Prussian blue is manufactured by different processes, but they are all based on the principle of mixing various salts of iron with red or yellow prussiate, when double cyanides of iron (or Prussian blues) are produced.

I shall now examine with you some of the various causes which contribute to the destruction of animal matters, when it arises from slow decay or putrefaction. The first of these to which I shall have the pleasure of calling your attention, is that observed by Dr. Stenhouse, who, in 1854, made the curious discovery that, if the body of an animal be buried in a carbonaceous mass, such as charcoal, after a few months the whole of the animal, excepting the skeleton, would entirely disappear; and, what was still more remarkable, was that, though the experiments were conducted within his laboratory, no unpleasant effluvia were apparent to those who were constantly there. This eminent chemist attributed the rapid and complete destruction of animal tissue in these experiments, to the oxidation of the animal matters by the oxygen of the atmosphere; but to enable you fully to understand how this occurs, I must call your attention to the following facts. Lowitz, many years since, observed that charcoal possesses the property of absorbing and condensing in its pores large quantities of various gases, and Theodore de Saussure made an extensive series of experiments, from which I extract the following data:—

One cubic inch of boxwood charcoal, absorbed of—

Ammonia	90	cubic inches.
Hydrochloric acid	85	,, ,,
Sulphurous acid	65	,, ,,
Sulphuretted hydrogen	55	,, ,,
Carbonic acid	35	,, ,,
Oxygen	10	,, ,,
Nitrogen	7	,, ,,

Consequently the absorption or condensation of a gas in charcoal appears to be in proportion to the solubility of the gas in water, and although the condensation by a solid and by a liquid may at first appear necessarily due to different causes, and therefore to bear no relation to each other, yet in my opinion these two actions are identical. Seeing that the gas is condensed by the molecular attraction of the solid, I do not see why the same attraction should not be exercised by the molecules of the liquid. The different degrees of solubility of various gases are no doubt owing to their respective physical properties, such as specific gravity, repulsive or expansive forces of their molecules, &c. I may here mention that I am now engaged in a series of experiments in the hope of throwing some light on this interesting question.

Gay-Lussac in his researches on the condensation of gases by charcoal, found that one gas may expel and take the place of another gas already condensed in the charcoal; and Dr. Stenhouse, following up this observation, states that the gases, vapours, and sporules generated by the putrefaction of animal substances, are absorbed by charcoal and brought into immediate contact with the oxygen of the atmosphere also contained in the pores of the charcoal, which oxidising or destroying the products of putrefaction converts them into water, carbonic acid, nitric acid, &c. These important scientific observations of Dr. Stenhouse have already received practical application; thus Mr. Haywood has established charcoal filters at the mouths of public drains, thereby arresting the escape and diffusion in the atmosphere of the noxious effluvia given off by the putrefying matters in the sewers. Further, charcoal respirators have become extensively used since Dr. Stenhouse called public attention to the valuable properties of this substance; and lastly, atmospheric filters, containing charcoal, have been successfully applied in the houses of Parliament to purify the entering air from any noxious gases it may contain before passing into the building. The natural decay or destruction of organic matters is due to two perfectly distinct causes, one of them chemical and the other physiological. The former has been investigated by many of the most eminent chemists of the day, and no doubt can remain that the action of the oxygen of the atmosphere converts the carbon of organic substances into carbonic acid, the hydrogen into water, the sulphur into sulphuric acid, the nitrogen into nitric acid, the phosphorus into phosphoric acid, &c. Much light has recently been thrown upon these phenomena by Mr. Kuhlman, who clearly shows that the oxides of iron play a most important part therein; thus that the sesquioxide of iron yields its oxygen to the elements of the organic matters; that the protoxide of iron thereby formed absorbs oxygen from the air, which reconverts it into sesquioxide, and this again yields its oxygen to a fresh portion of organic matter, so that sesquioxide of iron is a most powerful oxidising agent, it being, in fact, the condenser of oxygen and the medium of its conveyance to and destruction of organic substances. MM. Chevreul and Kuhlmann have also shown that sulphate of lime acts in a similar manner, namely, that it yields its oxygen to the elements of organic substances, and is thus converted into sulphuret of calcium, which having a great affinity for oxygen is again rapidly converted into sulphate of lime, and thus the oxygenation and destruction of the organic matter is effected. Mr. Millon has published an interesting paper on the formation of nitre, or nitrate of potash, through the ammonia generated during the destruction of organic substances being oxidised into nitric acid, which combines with potash, if present, and if not with lime or magnesia, which are present in all soils. Mr. Millon has remarked that this important chemical reaction is effected by an organic substance called humic acid, which acid, or its homologues, exists in large quantities in all earthy loams containing much organic, and more especially vegetable, matters in a state of decomposition. Humic acid absorbs the oxygen of the atmosphere, which oxidises the ammonia into nitric acid and water. The chemical theory of the destruction of organic matters through oxidation and their absorption of plants and re-conversion into the same substances from which they were derived, such as sugar, starch, gum, oil, essences, &c., or albumen, fibrine, gluten, caseine, &c., was greatly in favour a few years since, as it appeared to fulfil all the requirements of nature. It has, however, been greatly shaken by the beautiful researches of M. Pasteur on fermentation, putrefaction, and spontaneous generation, which prove clearly that these physiological actions play a most active part in the destruction of organic substances. This most skilful chemist has demonstrated that there is no such thing as spontaneous generation, and that the notion entertained by some physiologists, that if matter is placed in favourable circumstances as to heat, light, &c., and in a proper medium, it will become spontaneously animated, is undoubtedly erroneous, and that life in all instances proceeds from a germ or egg in which the vital principle is implanted by the Creator. He proves that life, even in the most insignificant of microscopic creatures, always originates thus, and that there is no single instance of matter being animated by purely physical causes. Let me draw your attention to a few among many facts observed by M. Pasteur, proving that life is not a property of matter, like weight, elasticity,

compressibility, &c., but is always the result of a germ even in its lowest development.

When arterial blood is carefully introduced from the artery into a clean vessel, and there brought into contact with oxygen, no fermentation or putrefaction of the blood ensues; and if the experiment is repeated, substituting for the chemically prepared oxygen, atmospheric air which has been passed through a tube containing pumice stone and carried to intense heat, in this case also, there is no putrefaction or fermentation; but if ordinary atmospheric air be used in the place of pure oxygen, or heated air, and left in contact with some of the same blood, this vital fluid will rapidly putrefy, which is doubtless owing to the presence in the atmospheric air of the sporules or eggs of mycoderma and vibrios, or organised ferments, which give rise to the various chemical phenomena and changes of organic matters into products which characterise fermentation and putrefaction. The same results are obtained when fresh urine is substituted for blood, an important fact, proving that the germs of fermentation do not exist in the fluids themselves, and that fermentation does not proceed from any molecular or chemical change in the composition or nature of the organic substances contained in blood and urine, but that the ferment from which these phenomena proceed is to be sought for in the atmosphere. I shall substantiate this view by several other interesting observations made by M. Pasteur.

If some asbestos is heated to a red heat and plunged into a liquor susceptible of putrefaction, such as a saccharine liquor, no fermentation ensues, but if atmospheric air is passed through asbestos at natural temperature, and the latter then immersed in a similar solution of sugar, active fermentation soon takes place, proving that the atmospheric air has left on the surface of the asbestos sporules of the mycoderma vini, which being introduced with the asbestos into the saccharine fluid, originated the well-known alcoholic fermentation. Another beautiful series of experiments by M. Pasteur is the following:—He introduced into 60 small balloons a small quantity of a highly putrescible fluid, and after boiling the fluid in order to drive out the air remaining in the balloons by the formation of steam, he closed the small apertures, so that on cooling the steam condensed and a vacuum was produced. He then proceeded to open 20 of these balloons at the foot of one of the hills of the Coté d'Or, 20 others at the summit of the same (about 2,000 feet high, and the remaining 20 at a point near Chamounix, and the following results were observed: Of the first 20 balloons the contents of 15 entered into purefaction within a few days; of the second 20 only 6; and of the third 20 only 2 gave signs of fermentation. These results, as well as some others published by M. Pasteur, prove that the sporules or germs of putrefaction and fermentation exist in all parts of the atmosphere, but more abundantly in the lower strata, which are necessarily in contact with great quantities of organic matter in a state of decay, and that these sporules become scarce in the upper regions of the atmosphere, which are further removed from the source of pollution. Further, he has proved, as I stated in my last lecture, when speaking of the preservation of milk, that fluids extremely liable to fermentation or putrefaction, may be prevented from entering into those conditions by heating them to 250° or 260°, a temperature at which the sporules cannot resist decomposition in the presence of water. M. Pasteur has advanced a step further in this interesting inquiry, for he has demonstrated that there are two distinct phases in putrefaction. In the first there are the vibrios produced in the bulk of the fluid containing animal matters in solution, and that these microscopic animals resolve the organic substances into more simple compounds; in the second phase, there are produced on the surface of the fluid cryptogams, which he calls mycoderms, and which absorb oxygen from the air, and oxidise the products developed by the vibrios. In the case of the fermentation of vegetable substances, such as saccharine matters, there are mycoderms (*Mycoderma vini*), which resolve them into, say alcohol and carbonic acid, while other mycoderms (*Mycoderma aceti*) are produced, and grow on the surface of the fluid, oxidising the alcohol into water and acetic acid. He therefore concludes that the animal vibrios and vegetable mycoderms exist abundantly in nature, and that they must be and are the most active causes of the destruction of vegetable and animal substances which have fulfilled their vital function on the earth, reducing them into water, carbonic acid, ammonia, sulphuretted hydrogen, &c., which, in their turn, become the foods of a succeeding generation of plants and animals. We may therefore truly say that death is life in the constantly reviving world.

M. Pasteur has observed another most curious fact connected with these microscopic beings—(I say microscopic, because it requires a most powerful instrument and high powers to distinguish them, and to ascertain that vibrios possess a vibratory motion while mycoderms are stationary); this is, that vibrios are the only animals which can live in pure carbonic acid, and which are killed by oxygen even diluted with another gas. Oxygen is essential to the life of mycoderms, and some of them can also exist in carbonic acid. Lastly, M. Pasteur has noticed that if a very small amount of yeast is added to a saccharine fluid, the yeast will not materially increase in quantity, because the new generation which is produced lives on the remains of its parents; but if phosphate of ammonia or of lime and some sal ammoniac is added with the yeast, the latter will rapidly increase and occupy several times its original bulk. It is curious to observe that these microscopic cryptogams require the same kind of food as man. Thus they require nitrogenated food—so do we. They require mineral food, as phosphates—so do we. They require respiratory food—so do we. They produce carbonic acid as part of their vital functions—so do we. I cannot do better than conclude this part of my subject by giving the following table descriptive of the various ferments observed by M. Pasteur:—

Fermentation.

Mycoderma vini.	Resolves sugar.	Alcohol. Carbonic acid. Succenic acid. Glycerine.
Mycoderma aceti.	Oxidises Alcohol.	Acetic. Water.

Putrefaction.

Infusorial Ferments.

Vibrios resolve animal substances.

Bacterea oxidizes organic matters of an animal origin.

I should mislead you, however, if I did not call your attention to another class of fermentations, which are chemical in their nature and in their action. This, for example, is the case when bitter almonds are crushed and mixed with water. The amygdaline they contain is decomposed into prussic acid, hydruret of benzoil, &c., by the ferment they contain, which is called emulcine. Again, when black mustard is reduced to meal, and placed in contact with water, the myronic acid it contains is decomposed into the essential oil of mustard, a most corrosive fluid, and this is also effected by a special ferment called myrosine. Again, when malt is mashed with water of a temperature of 170°, its starch is converted into sugar by a ferment called diastase. We also know that the starch which we take into our stomachs as food is converted into sugar by animal diastase, which exists in the saliva as well as in the pancreatic juice, and that this conversion is identical with that which takes place in the mashtub. In fact the whole of the changes which our food undergoes to render it fit for assimilation in the digestive organs of the body may be considered as a series of different fermentations. What gives a further interest to

these chemical ferments is, that not only are they all nitrogenated, and possess a similar composition, but they present many identical properties, but each has its own peculiar action, that is, it will only cause fermentation in those matters which have been placed by nature in contact with it. Thus diastase will not convert amygdaline into prussic acid, hydruret of benzoil, &c., nor will myrosine convert starch into sugar.

In conclusion, it is certain that our knowledge of these interesting phenomena of putrefaction, fermentation, &c., is yet in its infancy, and there is no doubt that many important discoveries in this intricate branch of knowledge will from time to time be brought before the world, and reward science for its persevering efforts.

Proceedings of Institutions.

Yorkshire Union.—The twenty-seventh annual report, presented at the annual meeting at Sheffield, on the 18th May last, congratulates the delegates on the continued success which has attended their exertions. The prominent position held by the Institutes of Yorkshire is shown by their large number of members which, on the aggregate, maintains its rate of increase, and testifies to the appreciation in which the work of popular education and social improvement continues to be held. In most of the departments of the Institutes there has been a continuous improvement. The summary of the returns for 1864 shows that the number of Institutes in the union was 131. The total number of members is estimated at 23,500. Those Institutes, from whom reports have been received, give the number of males at 18,464, and of females at 2,107. The annual income of 91 Institutes is £12,500. The number of volumes in libraries of 100 Institutes is 137,421. The number of books added during the year to 100 Institutes was 5,080. The number of lectures delivered at 60 Institutes was 407, of which 93 were paid and 314 gratuitous, and they have been classified as follows:—Scientific, 92; literary, 262; musical, 53. In 68 Institutes, containing 16,418 members, the number of pupils belonging to classes is returned at 6,761. During the year, the agent, Mr. Blake, has delivered 23 lectures, attended 17 soirées, and paid 62 visits to Institutions, for the purpose of giving advice and assistance. He has also superintended the Society of Arts Examinations, the examination of the Science and Art Department, and other examinations in connection with the Union. A few of the smaller Institutes have either ceased to exist, or have discontinued their operations for a time. Either an apathetic feeling for any mental imprevement amongst the young men of the neighbourhood, or the want of suitable premises in which to meet, or the absence of any energy or perseverance in those who should manage the Institute, or the difficulty of obtaining competent teachers at such a rate of remuneration as could be met by class fees; these causes have more or less operated injuriously in some few places, whilst in many places difficulties of a similar character have been overcome by a really efficient secretary, with the aid of perhaps two or three practically working members of a committee. It has sometimes been the case that the loss of a good secretary has been followed by serious damage to the welfare of an Institute, if it has not altogether proved fatal. On the other hand, a slight majority of the Institutes in the union show an increase in the number of members. Some portion of the increase in the number of members may be attributed to the judicious introduction of entertainments of a character more attractive to the great bulk of the population. Attention has before been directed to the advantage of popular readings at a small charge for admission. At Skipton the plan of penny readings has been tried with such great success as to have been introduced into a considerable number of the surrounding villages. The last series consisted of 24 meetings, and the total receipts were £97, leaving a balance of £41 in favour of the Institution after payment of all expenses. From the report it appears that the chairmen who officiated at the meetings included the leading clergymen, ministers, magistrates, professional and private gentlemen. The Ripon report refers to the no doubt very frequent complaints made by the promoters of Mechanics' Institutes, that their Institutions languish and are not sufficiently supported by the working classes. The report then proceeds to contrast the great comparative success of public houses in attracting the presence of the working classes, and goes on to inquire whether the Institutions are not aiming too high, and whether they would not succeed better provided they introduced at least a few of those features which render the public-house so successful in securing the presence of the working man. That these views have considerable force in them, is shown by the success which has attended the recent efforts to establish working men's clubs in various parts of the country. The great feature of these clubs as distinguished from ordinary Mechanics' Institutes, is the introduction of a more social character into them. Conversation is encouraged; chess, draughts, even a smoking room and singing are freely permitted. These features are obviously a great innovation upon the cold and formal aspect of Mechanics' Institutes as usually conducted, and the result has been a very much larger influx of the working men into the former class of Institutes. In Leeds for example, two Working Men's Institutes now contain as many operatives as all the fifteen Mechanics' Institutes of Leeds put together, and this, too, without having in any degree diminished the number of those in the Mechanics' Institutes. Musical entertainments as a popular recreation have been in operation at several Institutes, whilst a combination of reading, singing, recitation, and other means of passing an agreeable evening has been provided at others. Games of chess and draughts, as well as cricket, with other athletic sports, have been made a feature of several Institutes. It has been said that lectures, either as a means of instruction or enterment, have ceased to interest, and have been in a great measure superseded by other sources of attraction. This does not, however, appear to have been the case during the past year in the Yorkshire Institutes, as the returns show a slight increase in the whole number delivered, and this increase is not in those of a literary character, which have diminished, but in a small degree in those which are denominated scientific, and more largely in those devoted to music. The demands for gratuitous lecturers have somewhat decreased, while there has been an improvement in the employment of professional lecturers. Attention is called to the importance of having lectures delivered at regular and stated intervals, and in country places, where monthly lectures are alone practicable, it would be advisable to select an evening near the period of the moon being full, as light on a winter's night has a considerable influence on many persons undertaking a walk of any distance. In some Institutes the plan has been successfully adopted of canvassing the inhabitants generally to take season tickets for admission to a course of lectures, and the result has been not only to secure the committee against any risk of over expenditure, but also to induce many thus introduced to the Institute to become subscribers for its other advantages. The reading-rooms of the several Institutes are maintained in their efficiency. In some instances the cheerless appearance of the reading-room has operated to deter many from joining the Institute, whereas if it had combined warmth and light, with interesting publications for perusal, and such appearances of comfort as may be found elsewhere, it would be found a most valuable aid in exciting desire for mental improvement. With regard to the Examinations instituted by the Society of Arts, it is important, in order to render the system fully available, that the instruction in the classes of the Institute should have especial reference to the future examination. By this means the pupils would be in a better state of pre-

paration than by desultory efforts of their own. The success of the evening classes might be considerably promoted by the adoption of the system of Elementary Examinations which has been established by the Society of Arts. It not only forms an excellent preparation for the more advanced studies, but it affords encouragement at a period when encouragement is perhaps the most needed to stimulate the young to continue the education commenced in the day-school by attendance at the evening classes of the Institute. The elementary certificate, as the reward for the earliest efforts in mental cultivation, may often prove the most effectual stimulus to further efforts in the same direction. It has, moreover, the additional advantage of simplifying the Preliminary Examinations, which are indispensable in returning candidates for the Final Examinations of the Society of Arts. The system has thus far made very favourable progress.

PHOTOMETRIC BALANCE.

An apparatus for weighing the photometric standard candle has been designed by Mr. T. W. Keates, F.C.S., with the view of obviating the inconvenience, and in some measure the difficulty, of weighing the standard candle in experiments with Bunsen's photometer. The value of any means by which regular combustion of the candle in photometrical experiment can be secured is scarcely to be overrated. This is the element most easily disturbed in such experiments, and it is also that which is of the greatest relative importance, inasmuch as the candle is the standard of reference, and any irregularity in the manner of its burning necessarily affects the final results to a serious extent, especially when, as is often the practice, the experiment is only continued for a few minutes. Under all circumstances, however, it is essential that the burning of the candle should be rendered as regular as possible, and that the candle should be undisturbed and its burning uninterrupted after it has been weighed. These conditions cannot be fulfilled if the candle has to be lighted after weighing, nor if it has to be transferred whilst burning from the balance to the photometer. These difficulties the apparatus in question is intended to obviate. It consists in a particular arrangement of balance adapted to the beam of Bunsen's photometer at the end which supports the candle, and it is so contrived that it can be applied to any photometer of this construction. By reference to the woodcut it will be perceived that the candle at the moment of weighing takes the situation which it occupies during the photometrical experiment, and that the act of weighing is performed in such a manner that it does not influence in the slightest way the state of the flame; indeed, after the candle has reached its regular rate of combustion, it is not touched until the experiment including the second weighing of the candle is completed.

The balance employed in this apparatus, as it is shown in the drawing, is constructed with arms of unequal length—the distal arm, or that farthest from the candle, being twice as long as the other; the only object of this is the reduction of the weight of the counterpoise, which can thus be made of half the weight that would be required if the arms of the balance were of equal length. This not only facilitates the use of the instrument, but it diminishes the total weight upon the centre knife-edges.

REFERENCES TO THE WOODCUT.

A A. Balance-beam, with arms of unequal length.

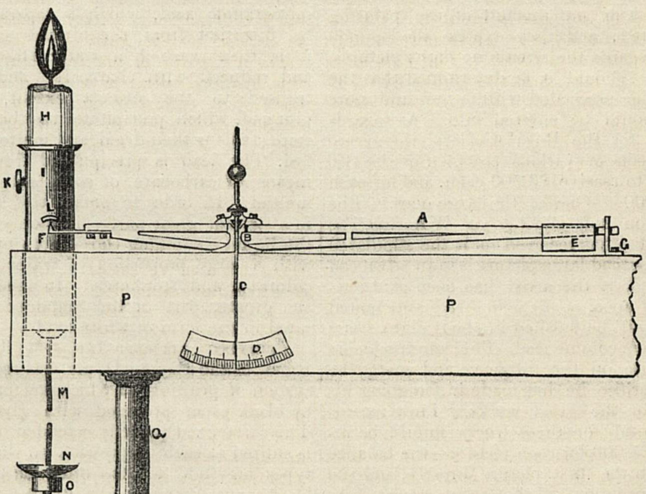
B. Support for centre knife-edges.

C. Index, with scale D.

E. Shifting saddle-shaped weight or counterpoise.

F. Knife-edge at extremity.

G. Rest for balance during the experiment.



H. Candle.

I. Case for candle.

K. Screw to adjust e height of the candle.

L. Steel projections, by which the candle-case is suspended on knife-edges.

M. Brass rod, to which is attached the small scale-pan, N, and the balance-weight, O.

P P. Portion of the end of the photometer-balance.

Q. Support to ditto.

In the drawing, the balance is shown in the position which it, and consequently the candle, would occupy during the photometrical experiment, with the trifling exception that the candle is one-tenth of an inch too low, as in the practical form of the instrument there is a contrivance for lifting the candle-holder off the knife-edges so soon as the weight of the candle is ascertained; this is done by a rack and pinion arrangement, which raises the candle-holder one-tenth of an inch, and holds it firmly whilst the power of the light is being estimated. Afterwards, the candle-holder is lowered again upon the knife-edges for the second weighing.

The manner of using this instrument is very simple. A few minutes before commencing the photometrical experiment, the candle, being placed to the proper height in the candle-holder, and fixed by the small screw, should be lighted and allowed to burn quietly until the flame has arrived at what may be termed, with reference to the photometer, its normal condition; this being so, the shifting counterpoise must be gently pushed along the balance-beam a little towards the centre, so as to allow the candle to carry down its end of the balance. Attention must now be given to the instrument for a short time. As the sperm is consumed and the candle becomes lighter, equilibrium will be restored to the balance, and the candle will very gently and gradually rise, so that the index of the balance will be brought to zero of the scale. At that moment the exact time by the clock must be observed, as this is the starting-point of the experiment so far as the consumption of sperm is concerned. The candle-holder

must next be raised very gently off the knife-edges, when the photometrical estimations can be carried on as long as may be required. When these are terminated, it only remains to make the second weighing of the candle. For this purpose the candle is extinguished carefully, and as quickly as possible, and the time which has elapsed between the moment at which the index of the balance pointed at zero of the scale and that at which the candle was extinguished, noted. The candle-holder is now again lowered upon the knife edges of the balance, and weights are placed in the small scale-pan hanging below the candle holder until the balance once more turns. These weights represent exactly the quantity of sperm consumed during the burning of the candle, the hour's consumption being, of course, a question of proportion.

Fine Arts.

THE FRESCOES IN THE HOUSE OF LORDS.—The Royal Commissioners appointed to consider the agreements made by the Fine Arts Commission with artists, in respect of the wall-paintings to be executed for the Palace of Westminster, have issued their report. They state that Mr. Herbert, in April, 1849, accepted the commission to paint nine of the pictures, which were to be completed in ten years, and for these he was to be paid £9,000. At the end of fifteen years only one of these subjects—" Moses Bringing Down the Tables of the Law"—is nearly finished, and three of the designs for the others have been submitted to the commission. Mr. Herbert has received £2,000 on account of the painting, and £1,800 on account of the designs. The commissioners recommend that a further sum of £3,000, in addition to the £2,000 already paid, be awarded to him, on account of the painting which he has completed; and they express the opinion that the contract, as regards the remaining eight pictures, should be cancelled, or, should it be determined that the other eight pictures be proceeded with, a new and more definite agreement should be entered into. As regards Mr. Maclise's pictures for the Royal Gallery, the agreement was for 18 subjects of various sizes. For the two largest the artist was to receive £3,500 each, and for each of the others say £1,000. One of the large ones, " The Meeting of Wellington and Blucher at Waterloo," is finished, and Mr. Maclise has received for it the stipulated price of £3,500. The second large picture is in an advanced state, and on account of it the artist has been paid one-half of the sum agreed upon, or £1,750. It is anticipated that these two works will be finished in about eight years from the time they were commenced. The commissioners compliment Mr. Maclise on the diligence and energy he has shown, and the sacrifice he has made in foregoing his private commissions for the great works. They recommend that the sum paid for these works should be increased to £10,000—£5,000 for each picture—the balance of £1,500 to be paid on the first picture directly, and the remainder on the completion of the other subject. As regards the other subjects, the agreement to be cancelled; or, if so determined, a fresh engagement might be entered into with the artist. The pictures for the Peers' Corridor and for the Commons' Corridor, by Messrs. Cope and Ward, are in a more advanced state. Mr. Cope has finished six, and Mr. Ward five, of the eight subjects which each gentleman undertook. It is recommended that they should be requested to complete their commissions with all reasonable despatch, and that £100 extra on the stipulated price for each piecture should be awarded to each artist. Of the seven compartments in the Queen's Robing room, as well as the twenty-eight smaller compartments in the same chamber which the late Mr. Dyce undertook, five of the seven large subjects were completed when he died. £5,600 had been paid to him; and the commissioners, in mentioning his premature death, consider that no interference or recommendation is necessary on this point. The report closes with the expression of a desire that in future there should not be any subsequent departure from any similar contract which may be deliberately agreed upon.

AUSTRIAN ART ASSOCIATION.—Vienna presents us with a very remarkable programme of an Art Exhibition, organised by the Austrian Artistic Association, of which rumour says the Duke of Saxe Coburg is the chief promoter. The Exhibition of this society is to be permanent, and, with certain exceptions, the works are to be changed once a month. Artists are required to send their works in only a week previously, but they must be examined and approved by the council of admission. A novel item in the regulations is, that artists are not required to send frames, the association announcing that it is provided in this respect for pictures of all sizes. The authorities have arranged that all cases addressed to the association shall pass the frontier and the douane without being opened, and the society pays the carriage both ways of all works sent after written invitation by artists abroad. Further, the directors of the Exhibition undertake the sale of works exhibited for 5 per cent. commission. An agency will shortly be opened in Paris, and there is no doubt that many French artists will gladly avail themselves of this opportunity of making their works known to the public of the Austrian capital.

Manufactures.

BISMUTH FROM OLD TYPE.—M. Balard, of Paris, has, in consequence of the high price of bismuth, tried the experiment of recovering it from old type metal, and he thus explains his mode of procedure:—1st. Dissolve in nitric acid, in order to transform all the tin into metastannic acid, which is separated from the solution by filtration from the nitrates of lead and bismuth; it is then washed in water slightly acidulated, dried, and reduced with charcoal. 2nd. In the liquid, neutralised to the utmost extent, strips of lead are plunged, which precipitate the bismuth in the metallic state; this is then dried and melted in the ordinary way. 3rd. The lead is precipitated from the last liquid by means of carbonate of soda, and afterwards dried and melted. In order to obtain the sub-nitrate of bismuth in a state of great purity, it is only necessary to neutralise the liquid containing the soluble nitrates, and to dilute it with a large proportion of water free from carbonates, chlorates and sulphates. In repeating these operations the greater part of the contained bismuth may be separated in the form of white oxide.

PRINTING WITHOUT INK.—M. Leboyer, a printer of Riom, in the Puy de Dôme, has recently patented a new system of printing, in which the printing ink is replaced by black paper, prepared with glycerine and lampblack. The carbonized paper is extended over two cylinders, and is shifted at each impression so that the pressure of the types may not fall too often on the same parts. The black paper remains always slightly moist, and may be used two, three, or more times. The convenience of such a system, provided the result be satisfactory, is self-evident, and it is quite possible that it may be applicable for address cards—to which M. Leboyer has specially applied it—and to some other applications of the same kind. Whether it can ever supersede ink for general purposes is a more difficult question to resolve.

SULPHATE OF SODA FROM COMMON SALT.—M. E. F. Anthon, of Prague, has announced a new method of extracting sulphate of soda from marine salt, by means of gypsum or sulphate of lime. The theory of his process is thus explained:—The carbonate of magnesia is decomposed by the gypsum forming on the one hand sulphate of magnesia, and, on the other, carbonate of lime, the salt in the water being transformed by the sulphate of magnesia into sulphate of soda, while the sulphate of magnesia is itself converted into chloride of magnesium. The

following is M. Anthon's mode of operation:—Take an equivalent of marine salt, of gypsum, and of calcined magnesia, and mix therewith water equal in weight to six or eight times that of the marine salt, then, while the mixture is kept in a state of continual agitation, introduce a current of carbonic acid gas until all the magnesia is thoroughly saturated; the solution is then poured off from the carbonate of lime, which is formed by the operation, and evaporated in order to separate by means of crystallization the sulphate of soda, and the chloride of magnesium remains in the mother water. The decomposition of the mixture given above is said to take three or four hours at an ordinary temperature. M. Anthon recommends, amongst other modes, for the preparation of the calcined magnesia, the use of magnesia precipitated by lime from salt water.

Commerce.

The Nitre Beds of Tacunga, Ecuador.—Last week, M. Boussingault communicated to the Academy of Sciences a paper on the nitre beds of Tacunga, in the state of Ecuador. Nitre, or saltpetre, is a substance formed by nature in astonishing abundance; it is to be met with in rain, snow, hail, and fogs; in the water of rivers, and consequently also in the ocean. It is produced in the air and in various soils; but, though found everywhere, it is seldom found in large quantities; the only spot on the globe where it is met with in this shape is Zarapaca, in Peru. Elsewhere this salt makes its appearance spontaneously, producing efflorescences on the surface not unlike vegetation. One day the soil is black and damp; the next is white and crumbles into dust. The saltpetre is collected by sweeping the surface, and if the weather continues fine, a new crop soon appears. It is thus obtained on the banks of the Ganges after an inundation; in Spain they obtain it by lixiviating vegetable mould, which may therefore serve the double purpose of a profitable nitre-bed or a rich corn-field. Tacunga is a town situated 59 minutes S. lat. and 80 deg. 10 min. W. long. from Paris; it was built in 1524, on the site of an Indian city; its altitude is 2,860 metres, its mean temperature 15 deg. centigrade. It lies between two rivers, the Alaque and the Cutnshee, and at the base of the Cotopaxi. Its soils rests on a bed of trachyte and volcanic tufa, and consists of fine sand containing particles of trachyte and pumice-stone. The saltpetre effloresces on its surface, and is collected as above described. A kilogramme of dry earth produces 18 per cent. of nitre, independently of nearly 2½ per cent. of nitrogen combined with organic substances. Efflorescence of saltpetre denotes an extremely fertile soil; indeed M. Boussingault considers fertility and nitrification to be intimately connected; the latter, however, depends in a great measure upon certain atmospherical conditions; thus, dry weather favours it; but damp, and especially rain, will dissolve and wash away the nitre already formed.

Railway Traffic.—The annual return from the Board of Trade concerning the railways of the United Kingdom exhibits in nearly every category a uniform increase for 1863 on the same statistics for 1862, whether it be in mileage, passenger traffic, goods traffic, or the several items of income and expenditure. Last year 173,605,485 passengers travelled on the railways in England and Wales, which, taking the population at something under 22,000,000, would give an average of say eight journeys for each individual. On the 31st of December, 1863, there were in all 8,568 miles of way open, over which 3,811,878 trains ran, carrying 173,605,485 passengers of all classes, exclusive of those who held season tickets, of whom there were 42,991. In connection with the passengers, there were carried at the same time 55,242 carriages, 226,439 horses, and 327,147 dogs. The goods traffic shows the following results:—There were carried 39,737,074 tons of coal and coke, and of all minerals 55,613,641 tons; of general merchandise, 26,471,928 tons; while 2,123,833 cattle, 6,076,908 sheep, and 1,270,561 pigs were also carried. The passenger trains travelled over 50,515,081 miles, while the entire distance travelled by all trains was 97,424,179 miles. The money received for the passenger traffic was £12,262,416; and for the goods traffic, £13,950,406; making the total receipts from all sources of traffic, £26,212,822. It is an important point to consider how this wonderful system of traffic has been performed in respect of safety. Of the 3,811,878 trains, 51 met with accidents; 44 of the accidents were to passenger trains; and of the 173,605,485 passengers, 11 were killed and 371 injured. The total number of passengers, servants, and others who suffered by accidents to trains in 1863, to all railways in England and Wales, was, 18 killed and 402 injured. There were 129 people killed and 419 injured from every cause on railways, including trespassers and people killed or injured at crossings. The amount paid as compensation for personal injury was £130,794. These are the general statistics, which may be divided into a more particular form. On the London and North-Western 19,185,751 persons travelled, exclusive of 5,372 season-ticket holders; there were 17 accidents, when two passengers were killed and 69 injured; £20,000 was paid as compensation for personal injury, &c. The receipts from passenger traffic were £2,365,322; from goods traffic £2,914,937; the proportion per cent. of expenditure to total receipts was 46, and the net receipts £2,866,849. The Great-Western carried 17,291,221 passengers, besides 1,975 holders of season tickets. There were seven accidents. One passenger was killed from his own misconduct, and 37 were injured from causes beyond their own control. This company paid £2,176 as compensation for personal injuries. The receipts were:—From passengers, £1,799,462; from goods, £1,666,196. The proportion of expenditure to receipts was 48 per cent., leaving a profit of £1,793,492. There were 11,011,661 passengers on the Great-Eastern line. Four accidents took place, by which seven passengers were killed and 33 received injuries, which cost the company £8,824 for personal compensation. £777,920 was received on account of passengers; £719,485 from goods; the working expense was 52 per cent., and the net income £719,903. The Great Northern had 6,003,515 passengers. There were seven accidents, whereby one passenger was killed and 18 injured. The per centage for working on this line was 50, and the total gross income £1,594,169; the net income £791,182. These returns will serve as examples of the great metropolitan lines; but the following particulars are subjoined to illustrate the working of the purely provincial undertakings:—The Lancashire and Yorkshire lines carried, during 1863, as many as 16,210,097 passengers, from whom an income of £741,107 was obtained, while the goods traffic yielded £1,037,154, making a total gross income of £1,778,261. The proportion per cent. of expenditure to total receipts was 47, and the net profits £947,479. There were three accidents, by which 21 passengers were injured, but none fatally. This company paid £8,351 as compensation for personal injury.

Railway Working Expenses.—The total working expenses of the railways in England and Wales in 1863 amounted to £12,659,618, against £12,050,581, in 1862; of the railways of Scotland to £1,617,204, against £1,520,056 in 1862; and of the railways of Ireland to £750,412, against £697,772 in 1862. The aggregate for the United Kingdom was thus £15,027,234 in 1863, against £14,268,409 in 1862. The length of line in operation at the close of 1863 was 12,322 miles, and at the close of 1862, 11,551 miles. The totals given do not include steamboat, canal, and harbour expenses; and the figures in 1863 are also exclusive of the working charges of the Oswestry and Newtown, Cowes and Newport, Brecon and Merthr Tydfil Junction, Cork and Kinsale Junction, Dowlais, and Hereford, Hay, and Brecon. The proportion of expenses to receipts appears to have been reduced

last year to 48 per cent., against 49 per cent. in 1862. The working expenses of last year may be analysed as follows:—Maintenance of way and works, 18·95 per cent., against 18·99 per cent. in 1862; locomotive power, 27·62 per cent., against 27·79 per cent. in 1862; repairs and renewals of carriages and waggons, 9·33 per cent., against 8·71 per cent. in 1862; traffic charges (coaching and merchandise), 27·92 per cent., against 27·95 per cent. in 1862; rates and taxes, 4·20 per cent., against 4·18 per cent. in 1862; government duty, 2·63 per cent., against 2·63 per cent. in 1862; compensation for personal injury, &c., 1·19 per cent., against 1·11 per cent. in 1862; compensation for damage and loss of goods, 0·46 per cent., against 0·48 per cent. in 1862; legal and parliamentary expenses, 1·30 per cent., against 1·54 per cent. in 1862; and miscellaneous, 6·40 per cent., against 6·62 per cent. in 1862.

Colonies.

Progress in Adelaide.—The treasurer's financial statement shows, in a cheering manner, the high state of prosperity which the colony enjoys at present. Never had a South Australian treasurer such a favourable report to present of the real material progress of the colony. On the 31st of March the population consisted of 141,563 souls, and it was estimated that at the close of this month, by natural increase and by emigration, there would be a population of 143,126. The gross total exports for the year ending 31st March, 1864, amounted in value to £2,738,226, being an increase over those of the previous year, up to the same date, of £473,120, or nearly 21 per cent. The staple productions of the colony are cereals, wool, and copper, and the amount of export of those articles is most encouraging. From the 31st March, 1863, to the same date 1864, the value of cereals exported was £1,011,989, being an increase over the preceding year of £307,511. But taking the half-year ending March, 1864, as compared with the corresponding period in 1863, the increase is still greater. For the six months in the former year the exports of cereals amounted to £373,247, while for the six months in this year they were £595,181. By the time the surplus cereals of the present year which can be spared for export are disposed of it is estimated that their value will amount to £1,310,000. This large amount arises from two causes—first, from the favourable yield of the last harvest, and secondly from the high prices prevailing. The serious failure of the crops in the other colonies has caused a large demand for our cereals, and thus large prices have been obtained. To show the importance of South Australia as a wheat-producing country, as compared with other wheat growing lands, the treasurer states that in California there were 263,208 acres sown, which produced 4,147,649 bushels, while in South Australia 335,758 acres gave 4,691,918 bushels. The population of California is 380,000, while that of this colony is something over 140,000. California, then, with nearly three times the population of South Australia, produced a less quantity of wheat; and her requirements for her own population being nearly three times as great as those of this colony, her surplus available for export will be proportionately less. If these figures are correct we do not think that our wheat-growers need be under very serious apprehensions that California will drive them out of the markets of the neighbouring colonies. The export of wool for the year ending March 31, was £770,835, against £682,991 for the previous year, or an increase of nearly £90,000. The export of copper had still more largely increased, showing £595,303 as compared with £321,736 the preceding year. The imports for the year ending 31st March, 1863, were in value £1,842,734, in 1864 they were £206,244, an increase of 12 per cent. The quantity of land disposed of in this colony is 2,750,000 acres, or an average of nearly 20 acres to each head of the population. In Victoria the proportion was under nine acres. In Victoria the cultivated area gives only four-fifths of an acre to each individual, whilst in this colony it gives nearly four acres. Vine-growing has become an important branch of our industry, and we find that during last year there were 5,779 acres laid down in vineyards, being an increase of one-fourth on the previous year. The vintage of 1863 yielded 606,365 gallons, showing an increase of 133,538 gallons on the former year.

Tasmania.—The total customs' duties collected during the eleven months from July 1, 1864, to May 31, 1864, were—at Hobart Town, £66,042 7s. 3d.; and at Launceston, £62,575 2s. 5d., together £128,617 9s. 8d. Of this amount £13,615 6s. 4d. was for measurement duty, £7,917 8s. 10d. having been collected at Hobart Town, and £5,697 17s. 6d. at Launceston. Supposing the revenue of the current month to be the average of the previous eleven months, say £11,500, it will give the customs' revenue for the year ending 30th June, in round numbers, £140,000. Ministers expected to get £135,000. The revenue yielded by the Stamp Act cannot be accurately ascertained, as postage stamps have been generally employed. During the quarter ending 30th September, 1863, the sale of stamps showed a decrease, but the Stamp Act came into force on the 1st of October, and at 31st December, 1863, there was an increase of £341 3s. 9d, and for the quarter ending 31st March an increase of £1,115 4s. 5d. If the increase on the last two quarters is ascribed to the operation of this Act, we may set down the revenue it will have furnished at the end of the present month at £2,000, or about £3,000 per annum. The Carriage Duties Act came into force on the 15th October, 1863, and to 31st December it yielded £1,336, during the quarter ending 31st March £304, and for April and May £144, altogether £1,728. If continued for twelve months it would probably yield £1,900—ministers calculated upon £1,750. In noticing the Land Fund, it is only necessary to say that the quarter ending 31st September last manifests an increase of £2,836 9s. 7d. over the corresponding period of 1862—the quarter ending 31st December shows a decrease of £2523 5s. 3d., and the March quarter of the present year shows an increase of £15,527 8s. 9d. The latter large augmentation arose on the sale of land taken up under the old prescriptive right regulations, and payment for which in the beginning of the present year, or forfeiture, was required by an act passed last session. On the whole, the revenue appears to have been pretty well sustained by the numerous and novel expedients adopted for the purpose. It remains to be seen whether the expenditure has been watched as narrowly, and whether the statements which the treasurer is expected to make will prove acceptable to parliament and the country.

Publications Issued.

Map of Africa During the Roman Domination.—(*Dumaine*, Paris.) The topographical department of the Ministry of War, having completed the map of France, upon which it has been almost exclusively occupied for thirty years, this important *bureau* has been re-organised, and a series of new and important works commenced. Amongst the first fruits is a recently-published map of Africa during the time of the Romans, printed in fine colours, on two large sheets, and accompanied by an explanatory notice or key. The map takes in all that portion of Africa which lies between Morocco and Egypt, and between the Mediterranean and the 27th degree of latitude; and we are assured that the director of the work, Captain Nau de Champlouis, has availed himself of the most recent and authentic information. The physical configuration of the country is indicated with great care, and this is made the basis of the historical geography of the locality. The great object of the map in question is to give Africa as it was under the Romans as compared with

the results of modern geography. With this view the ancient and modern names of places are given side by side, and distinguished by different colours, and a list of the Latin names is appended, with references to the localities which they represent on the map. One difficulty in the work was the fixing a certain date to that which related to the Roman period. M. De Champlouis has therefore taken the administrative divisions as established by Caligula for his basis, and has placed four tables in the angles of the maps to indicate the progress of the Roman domination during the course of its existence. The map has been presented to the Institut by Marshal Randon, and has obtained the commendation of that important body.

Metrical Globe.—M. E. Gosselin, of Paris, has introduced a new idea into the arrangement of globes. He has produced a globe which gives all the most recent discoveries, including those of MM. Speke and Grant, in Africa, and he has added an important feature, namely, the giving to the surface of the artificial globe a certain proportion in relation to the earth itself. The base adopted is the metrical system, and the scale one in 50,000,000, so that the circumference of the globe being 80 centimetres two millimetres represent 100 kilometres. In calculating distances, therefore, it is only necessary to take the actual measurements on this artificial globe, write down the results, remove the decimal point five places to the right, divide by two, and you have an approximation to the actual distance on the surface of the earth. On this globe the aqueous portions are coloured blue, and the solid portions with a tint of bistre.

Notes.

Dublin International Exhibition, 1865.—An influential meeting was held on the 5th inst., at the Mansion House, Dublin, presided over by the Lord Mayor of that city, when the following committees of advice and assistance were appointed:—Lord Otho Fitzgerald, Earl of Rosse, F.R.S.; Sir R. Griffith, Bart.; Major-General Sir Thomas Larcom, K.C.B.; Sir Robert Shaw, Bart.; Vice-Provost Lloyd, Rev. T. Romney Robinson, William R. Le Fanu, Esq., C.E.; J. Tuffnell, Esq., M.D., F.R.C.S.I.; Richard Butcher, Esq., M.D., F.R.C.S.I.; George W. Hatchell, Esq., M.D., F.R.C.S.I.; B. B. Stoney, Esq., C.E.; R. C. Wade, Esq.: Francis Robinson, Esq., Mus. Doc.; J. F. Elrington, Esq., LL.D. Army.—Section No. 8.—Viscount Gough, K.P., G.C.B., P.C., K.S.I.; General Key, Colonel Wetherall, C.B.; Colonel Whitmore. Navy.—Section No. 8.—Sir James Dombrain, Captain De Courcy, R.N.; Captain Wilcox, R.N., *Machinery.*—This class includes machines for direct use, carriages and railway and naval mechanism; manufacturing machines and tools; civil engineering, architectural, and building contrivances; naval architecture and military engineering, ordnance, armour, and accoutrements; agricultural and horticultural machines and implements; philosophical instruments and processes depending upon their use; photographic apparatus; musical, horological, and surgical instruments; machinery employed in spinning and weaving, and in the manufacture of wood and metal. &c.—David M'Birney, Esq., J.P.; C. P. Cotton, Esq., C.E.; J. Lentaigne, Esq., D.L.; J. West, Esq., J.P.; Hon. G. Handcock, Viscount Dunlo, J. E. Vernon, Esq., D.L.; John Vance, Esq., M.P.; the Earl of Howth, Anthony Lefroy, Esq., M.P.; Ion T. Hamilton, Esq., M.P.; Hon. St. John Butler, Right Hon. the Attorney-General for Ireland, Lord St. Lawrence, the Earl of Meath, Charles E. Bagot, Esq., Percy Fitzgerald, Esq., *Metallic, Vitreous, and Ceramic Manufactures.*—This class embraces cutlery and edge tools; iron and general hardware; working in precious metals and in their imitation; jewellery, and all articles of virtu and luxury, not included in the other classes; glass; ceramic manufacture, china, porcelain, earthenware, &c. *Miscellaneous Manufactures.*—H. Fry, Esq.; Sir Robert Kane, F.R.S.; James Forrest, Esq.; Sir R. Griffith, Bart.; A. H. Bagot, Esq.; Right Hon. the Lord Mayor; R. G. Collis, Esq.; Alderman Atkinson, J.P.; Arthur Guinness, Esq.; Hugh Brown, Esq.; Sir Robert Shaw, Bart.; Samuel Law, Esq., Governor, Bank of Ireland; Lord Viscount Southwell; John Hatchell, Esq.; Solicitor-General; John Henry Richards, Esq.; Arthur Usher, Esq.; J. Pim, Esq. *Fine Arts.*—The Lord Chancellor, Lord Talbot de Malahide, F.R.S., F.S.A., F.G.S., D.L.P.; Marquis of Kildare, Marquis of Drogheda, Viscount Powerscourt, Lord Cloncurry, Judge Berwick, Sir Bernard Burke, Sir J. J. Coghill, Bart, J. E. V. Vernon, Esq., D.L.; C. Smith, Esq., P.R.H.A.; George F. Mulvany, Esq., R.H.A.; Thomas A. Jones, Esq., R.H.A.; J. R. Kirk, Esq., R.H.A.; M. A. Hayes, Esq., R H.A.; General Colomb, William M'Kay, Esq., LL.D.; Jacob Owen, Esq.; Francis R. Davies, Esq.; S. C. Hall, Esq.; Right Hon. Alexander M'Donnell, Earl of Charlemont, Sir Thos. Dean, Sir John Benson, Sir George Hodson, Bart. Mr. Parkinson (Secretary to the Exhibition Committee) said that the result of the circulars sent out had been most satisfactory. The refusals had been few and far between. The meeting was addressed by Mr. B. L. Guinness, the Earl of Meath, Lord Powerscourt, Mr. Gilbert Saunders (Chairman of the Executive Committee) Mr. Wm. Dargan, Sir George Hodson, Sir Bernard Burke, and others.

North London Working Men's Exhibition.—On Wednesday evening, the 17th of August, a meeting was held in Amwell-street schoolrooms, Clerkenwell, for the purpose of promoting an industrial exhibition similar to that held last winter in Lambeth, for the large and important industrial district comprised in that portion of North London covered by Clerkenwell, Islington, St. Luke's, Hoxton, Holborn, and St. Pancras. Mr. Thomas Winkworth, member of the Council of the Society of Arts, occupied the chair, and after giving a condensed history of the exhibitions held in this country under the auspices of the Society, with the late Prince Consort at its head, went on to say that in those exhibitions the skilled artisan was to a great extent practically ignored, inasmuch as the persons invited to exhibit were generally employers of labour, and not workmen. Hence the masters took the lion's share of the honour; but then it must not be forgotten that they found the capital and ran the risk. To obviate this apparent unfairness the Society of Arts determined to follow out its original idea of encouraging the talent of the workman, and offered prizes to artisans willing to compete in various important branches of skilled industry. The Lambeth Exhibition on this principle had been held last year, and he hoped to see the same thing repeated in North London. After other remarks, made for the encouragement of the intending exhibitors, explanations of the details of the proposed exhibition were given by the hon. secretary, Mr. Watts, by Mr. Wm. Harvey, and other gentlemen. The exhibition is to be held in October next, in the Islington Agricultural Hall, and the exhibitors are to be working men and women and small masters. Resolutions approving the exhibition were agreed to, and the meeting separated.

Mining in France.—A report on the number of concessions granted for the working of mineral deposits in France shows that this branch of industry is progressing rapidly. It appears that there exist in force 490 grants for the working of coal, covering in all a superficial area of 5,226 kilomètres, spread over the following *departments*:—Loire, Gard, Aveyron, Isère, Hérault, Saône-et-Loire, Basses Alpes, Nord, Bouches-du-Rhône, Hautes-Alpes, Allier, Pas-de-Calais, Mayenne, Maine-et-Loire, Haute-Loire, Haute-Saône, Var, Puy-de-Dôme, Moselle, Ardèche, Sarthe, Bas-Rhin, Vaucluse, Aude, Creuse, Cantal, Vendée, Vosges, Corrèze, Rhône, Ain, Loire-Inférieure, Drôme, Tarn, Dordogne, Jura, Finistére

Landes, Calvados, Nièvre, Manche, Yonne, Deux-Sèvres, Doubs, Hautes-Pyrénées, and Pyrénées-Orientales. The kilomètres is rather more than three-fifths of a mile, English. The iron mines opened are given at 124,382 hectares, or, in round numbers, 300,000 acres English, divided amongst the following departments:—Isère, Pyrénées Orientales, Gard, Moselle, Saône-et-Loire, Ardèche, Aude, Aveyron, Doubs, Loire, Ain, Manche, Nord, Hérault, Jura, Haut-Rhin, Basses-Pyrénées, Vosges Saône-et-Loire, Ariége, Bas-Rhin, Côte-d'Or, Corse, Var, Creuze, Corrèze, Vaucluse, Puy-de-Dôme, Drôme, and Haute-Marne. Besides the permissions or concessions for coal and iron mining, there are 247 in force for other minerals, including graphite, bitumen, pyrites, salt springs, rock-salt, antimony, manganese, and other metals and sulphur.

Agriculture in France and England.—The reports which have appeared in connection with agricultural exhibitions exhibit French agriculture as falling far short of perfection. It appears by the returns of the statistical department of the Minister of Agriculture that the average yield of wheat in France is just half of that of England; the department of the Seine, which exhibits the highest cultivation, produces but 25·72 hectolitres per hectare, while the general average of France is 13·64, and that of England 27 hectolitres; 43 departments yield far less than the average, 9 of them only 8·17. The fact of the minute subdivision of the land having a constant tendency to produce a low condition of farming is admitted on all hands—a poor farmer always farms badly—but it is taken for granted that no change in the national habit can be made in that respect. As regards drainage, it appears that with all the aids afforded by the Government only 145,000 hectares have been drained, although the profit derived from the operation is calculated at 20 per cent. on the outlay.

Flax.—An unusually large breadth of land is this year under flax cultivation in Ireland, and there is every prospect of a good crop. The accounts from the Continent are also more favourable than last month, but generally the crops there will fall short of those of 1863.

Church Towers.—The tower of Strasburg Cathedral has heretofore been considered the highest in Europe, and that of Saint-Etienne, in Vienna, the next in altitude, the former being 449 and the latter 439 feet high. The tower of the latter edifice is now being rebuilt, and when finished will o'ertop that of the former by five feet.

Locomotives.—The number of locomotives owned by the railway companies of the United Kingdom at the close of the year 1863 was 6,643. At the close of 1862 the corresponding number was 6,398.

Patents.

From Commissioners of Patents Journal, August 19th.

Grants of Provisional Protection.

Anchors, construction of—1830—E. Snell and G. Allibon.
Boats, construction and propulsion of—1965—S. L. Cousins.
Bottles and jars, envelopes or covers for—1880—E. Brimson.
Buttons, manufacture of covered—1898—G. A. Huddart.
Cane, machinery for preparing—1943—A. Guthrie and T. Tracey.
Carriage steps (folding)—1985—J. Grice, jun.
Casks for liquids—1955—W. R. Taylor.
Caster—1969—W. E. Gedge.
Cocks for supplying water—1971—L. Young.
Cornets and other musical wind instruments—1896—H. J. Distin.
Cotton, wool, &c., pressing and packing—1947—F. Thornton.
Crinolines—1918—C. Hochgesangt.
Dyeing and printing, green colouring matters for—1913—H. Carter.
Electric telegraphs—1973—P. A. J. Dujardin.
Fabrics, apparatus for coating with medical or other compounds—1916—F. D. Delf.
Fibrous materials, machinery for breaking, scutching, &c.—1926—E. Brasier.
Fire-arms—1805—J. Syme.
Fire arms, breech-loading—1888—R. Redman and D. Kirkwood.
Fire-arms, breech-loading—1967—W. Collins and W. Pountney.
Fire-arms, &c.—1993—B. H. Mathew.
Foulardine (fabric)—1928—W. E. Gedge.
Furnace bars—1945—J. Gothard and H. Garland.
Furnaces—1892—E. B. Wilson and C. De Bergue.
Healds for weaving—1959—R. Edmondson.
Hydraulic cranes—1930—P. G. B. Westmacott.
Land, apparatus for cultivating—1991—R. Dannatt.
Metals, apparatus for making moulds for casting—1951—J. Heydon.
Placards, signals, &c., producing luminous—2001—R. A. Brooman.
Postage stamps, &c., apparatus for affixing—1914—H. T. Davis.
Potteryware glazes and enamels for—1920—J. H. Johnson.
Power looms—971—W. E. Gedge.
Printing type, manufacture of—1999—A. V. Newton.
Railways, securing rails on the permanent way of—1997—J. Lang.
Railway stations, sweeping the platforms of—1908—C. Eastwood.
Railway trains, communication between passengers and guards—1906—E. Tattersall.
Railway trains, communication between the guards and passengers—1820—W. Booth.
Railway trains, communication between the guards and passengers—1868—W. Dicey.
Railway trains, signalling on—1796—T. Wilson.
Reporting, type writing machine for—1983—J. Pratt.
Rivet holes, apparatus for rimming, &c.—1995—J. Russell.
Sails, apparatus for reefing or furling—1910—W. Pearson and W. Smallwood.
Sewing machines—1932—A. L. Wood.
Sewing machines—1934—C. Bolton.
Shipbuilding, &c., treatment of iron plates for—1963—N. McHaffie.
Ships of war, construction of—1961—C. P. Coles.
Ships, prevention of the fouling of the bottoms of—1941—F. Cruickshank.
Slide valves—1885—R. D. Sanders.
Spring tension regulator—1987—G. Haseltine.
Steam engines, packing and lubricating parts of—1912—H. Attwood.
Stone, machinery for driving drifts through—1904—F. E. B. Beaumont.

Inventions with Complete Specifications Filed.

Fluids, apparatus for pumping—1966—G. A. Nowell.
India-rubber, apparatus for cutting—1940—G. E. M. Gerard.
Pianofortes—1939—T. J. V. Roz.
Ploughing machines—2028—A. B. Childs.

From Commissioners of Patents Journal, August 23rd.

Patents Sealed.

451. T. J. Hughes.	527. G. Gaze.
452. J. Sanders, jun.	536. J. Crutchett.
455. J. H. Horsfall.	556. H. Cochrane.
458. W. Rowan.	609. H. E. Clifton.
460. A. Wall.	610. J. Shortridge and J. B. Howell.
462. L. A. Durrieu.	664. B. Day.
477. J. H. Johnson.	708. E. Borrows.
482. A. Prince.	725. W. Howe.
487. T. C. Barraclough.	851. W. Clark.
489. G. Birtwistle & R. Furnival.	1283. J. Fowler, jun.
494. H. Barwell.	1351. J. Fowler and T. Webb.
501. W. E. Gedge.	1420. W. E. Newton.
504. J. Chapman.	1565. J. D. Adams.
518. L. A. Laniel.	

Patents on which the Stamp Duty of £50 has been Paid.

2056. G. T. Selby.	2089. J. M. Murat.
2075. F. Gye.	2135. J. C. C. Azemar.
2117. J. Cranston.	2193. D. Ward.
2069. S. Whitaker & R. A. Jones.	2088. M. A. F. Mennons.
2065. W. Fitkin.	2148. S. Corbett.

Patents on which the Stamp Duty of £100 has been Paid.

2217. T. Ingram.	2223. H. Cartwright.
2224. J. Dauglish.	

Registered Designs.

Croquet stand—4644—W. Cordeaux and C. Ernest, York.
Fastening for a bracelet or catch for articles of jewellery—4645—Hermann Van Dicom, Black Lion-street, Brighton.
The Izaak Walton paragon winch fitting—4646—Geo. Jacobs, 32, Cockspur-street, S.W.
Feeding trough—4647—Jno. Webb, Hawkedon, Birmingham.
Self-oiling top centre plate for floor door springs—4648—Mathew Walters Wilkes and Co., Birmingham.
Gun or rifle rack—4649—William Talley, Bletchley, Bucks.
Shirt cuff (the Dane)—4650—Jno. Lyon Field, 28, Winchester-crescent, Chelsea.
A spring bottle holder—4651—Elkington and Co., Birmingham.
A combined music stand and table—4652—Fredk. W. Burton, 20, Somerset-place, Hoxton.
Whipple tree for ploughs—4653—Edmund Edmund, Rugby.
Attachment for the inside handles of carriage doors—4654—Josiah Adams, Birmingham.